## CLAIMS

1. An optical interleaver comprising:

an interferometer which includes a coupler, a first phase shifter and a combiner;

wherein the coupler splits incident light into a first light beam and a second light beam and couples the first light beam and the second light beam to the first phase shifter;

wherein the first phase shifter includes a first light propagation element that propagates the first light beam along a first path between the coupler and the combiner and that includes a second light propagation element that propagates the second light beam along a second path between the coupler and the combiner, the first and second paths having different path lengths that contribute to a phase shift between light of the first light beam propagated along the first path and light of the second light beam propagated along the second path;

wherein the combiner interferometrically couples the first light beam with and the second light beam;

a second phase shifter which receives first light beam light propagated along the first path between the coupler and the combiner and imparts a first wavelength dependent variation in phase to the received first light beam light;

a third phase shifter which receives second light beam light propagated along the second path between the coupler and the combiner and imparts a second wavelength dependent variation in phase to the received second light beam light; and

a phase shift tuner which adjusts a phase shift imparted to the first light beam by the second phase shifter.

2. The optical interleaver of claim 1,

wherein the second phase shifter includes a first resonator with a partially reflecting front mirror and a substantially fully reflecting back mirror spaced apart by a first distance;

wherein the third phase shifter includes a second resonator with a partially reflecting front mirror and a substantially fully reflecting back mirror spaced apart by a second distance different from the first distance;

wherein the second phase shifter is disposed relative to the splitter and combiner so as to serve as the first light propagation element by receiving light of the first beam from the splitter and reflecting received light of the first beam to the combiner; and

wherein the third phase shifter is disposed relative to the splitter and combiner so as to serve as the second light propagation element by receiving light of the second beam from the splitter and reflecting received light of the second beam to the combiner.

3. The optical interleaver of claim 1,

wherein the second phase shifter includes a first Gires Tournois resonator; and

wherein the third phase shifter includes a second Gires Tournois resonator.

4. The optical interleaver of claim 1 wherein,

spacing of the second phase shifter from at least one of the splitter and the combiner is different from spacing of the third phase shifter from at least one of the splitter and the combiner and such different spacing results in the different path lengths of the first path and the second path.

5. The optical interleaver of claim 1,

wherein the second phase shifter includes a first Gires Tournois resonator;; and

wherein the phase shift tuner includes a piezo-electric spacer between the front mirror and back mirror of the first Gires Tournois resonator.

6. The optical interleaver of claim 1,

wherein the second phase shifter includes a first Gires Tournois resonator;

wherein the third phase shifter includes a second Gires Tournois resonator; and

wherein the phase shift tuner includes at least one wave plate rotatably mounted between the front mirror and back mirror of the first Gires Tournois resonator.

7. The optical interleaver of claim 1,

wherein the phase shifter includes a first wave plate rotatably mounted between the front mirror and back mirror of the first Gires Tournois resonator to change the free spectral range of the first Gires Tournois resonator and a second wave plate rotatably mounted to change the phase of light of the first beam.

8. The optical interleaver of claim 1,

wherein the second phase shifter includes a first Gires Tournois resonator; d

wherein the third phase shifter includes a second Gires Tournois resonator;

wherein the phase shift tuner includes a first wave plate formed rotatably mounted between the front mirror and back mirror of the first Gires Tournois resonator to change the free spectral range of the first Gires Tournois resonator and a second wave plate rotatably mounted to change the phase of light of the first beam; and

wherein at least one of the first wave plate and the second wave plate is only partially coated with an additional material that is at least partially transparent.

9. The optical interleaver of claim 1,

wherein the second phase shifter includes a first Gires Tournois resonator;

wherein the third phase shifter includes a second Gires Tournois resonator; and

wherein the phase shift tuner includes a cavity defined by the front mirror and back mirrors of the first Gires Tournois resonator, the cavity filled with a fluid optical medium which determines an index of refraction with the cavity.

10. The optical interleaver of claim 1,

wherein the second phase shifter includes a first Gires Tournois resonator;

wherein the third phase shifter includes a second Gires Tournois resonator; and

wherein the phase shift tuner includes a cavity defined by the front mirror and back mirrors of the first Gires Tournois resonator, the cavity filled with a fluid optical medium which determines an index of refraction with the cavity; and

wherein the phase shift tuner further includes means for changing the fluid optical medium in the cavity.

11. The optical interleaver of claim 9 wherein the fluid optical medium comprises a gas taken from the group consisting of N2, O2, Ne, Ar, Kr, Xe, SF6 and mixtures thereof.

12. The optical interleaver of claim 1 further including:

a second phase shift tuner which can adjust the variation in phase imparted to the second light beam by the third phase shifter;

wherein the second phase shifter includes a first Gires Tournois resonator;

wherein the third phase shifter includes a second Gires Tournois resonator;

wherein the second phase shifter is disposed relative to the splitter and combiner so as to serve as the first light propagation element by receiving light of the first beam from the splitter and reflecting received light of the first beam to the combiner; and

wherein the third phase shifter is disposed relative to the splitter and combiner so as to serve as the second light propagation element by receiving light of the second beam from the splitter and reflecting received light of the second beam to the combiner.

13. The optical interleaver of claim 12 wherein

spacing of the second phase shifter from at least one of the splitter and the combiner is different from spacing of the third phase shifter from at least one of the splitter and the combiner and such different spacing results in the different path lengths of the first path and the second path.

14. The optical interleaver of claim 12,

wherein the first phase shifter includes a piezo-electric spacer between the front mirror and back mirror of the first Gires Tournois resonator; and

wherein the second phase shifter includes a piezo-electric spacer between the front mirror and back mirror of the second Gires Tournois resonator.

15. The optical interleaver of claim 12,

wherein the first phase shifter includes at least one wave plate rotatably mounted between the front mirror and back mirror of the first Gires Tournois resonator; and

wherein the second phase shifter includes at least one wave plate rotatably mounted between the front mirror and back mirror of the second Gires Tournois resonator.

16. The optical interleaver of claim 12,

wherein the first phase shifter includes a first wave plate rotatably mounted between the front mirror and back mirror of the first Gires Tournois resonator to change the free spectral range of the first Gires Tournois resonator and a second wave plate rotatably mounted to change the phase of light of the first beam; and

wherein the second phase shifter includes a first wave plate rotatably mounted between the front mirror and back mirror of the first Gires Tournois resonator to change the free spectral range of the second Gires Tournois resonator and a second wave plate rotatably mounted to change the phase of light of the second beam.

17. The optical interleaver of claim 12,

wherein the first phase shifter includes a first wave plate formed rotatably mounted between the front mirror and back mirror of the first Gires Tournois resonator to change the free spectral range of the first Gires Tournois resonator and a second wave plate rotatably mounted to change the phase of light of the first beam;

wherein at least one of the first wave plate rotatably mounted between the front mirror and back mirror of the first Gires Tournois resonator and the second wave plate rotatably mounted to change the phase of light of the first beam is only partially coated with an additional material that is at least partially transparent;

wherein the second phase shifter includes a first wave plate formed rotatably mounted between the front mirror and back mirror of the second Gires Tournois resonator to change the free spectral range of the second Gires Tournois resonator and a second wave plate rotatably mounted to change the phase of light of the second beam; and

wherein at least one of the first wave plate rotatably mounted between the front mirror and back mirror of the second Gires Tournois resonator and the second wave plate rotatably mounted to change the phase of light of the second beam is only partially coated with an additional material that is at least partially transparent.

18. The optical interleaver of claim 12,

wherein the first phase shifter includes a first cavity defined by the front mirror and back mirrors of the first Gires Tournois resonator, the first cavity filled with a fluid optical medium which determines an index of refraction within the first cavity; and

wherein the second phase shifter includes a second cavity defined by the front mirror and back mirrors of the second Gires Tournois resonator, the second cavity filled with a fluid optical medium which determines an index of refraction within the second cavity.

19. The optical interleaver of claim 12,

wherein the first phase shifter includes a first cavity defined by the front mirror and back mirrors of the first Gires Tournois resonator, the first cavity filled with a fluid optical medium which determines an index of refraction within the first cavity; and

wherein the first phase shifter further includes means for changing the fluid optical medium within the first cavity; and

wherein the second phase shift tuner includes a second cavity defined by the front mirror and back mirrors of the second Gires Tournois resonator, the second cavity filled with a fluid optical medium which determines an index of refraction within the second cavity; and

wherein the second phase shift tuner further includes means for changing the fluid optical medium within the second cavity.

20. The optical interleaver of claim 19,

wherein the fluid optical medium within the first cavity comprises a gas taken from the group consisting of N2, O2, Ne, Ar, Kr, Xe, SF6 and mixtures thereof; and

wherein the fluid optical medium within the second cavity comprises a gas taken from the group consisting of N2, O2, Ne, Ar, Kr, Xe, SF6 and mixtures thereof.

21. An optical interleaver comprising:

a first interferometer which includes a first coupler and a second coupler which are interconnected by a first waveguide which defines a first light path between the first coupler and the second coupler and which are interconnected by a second waveguide which defines a second light path between the first coupler and the second coupler; wherein the first and second light paths have different path lengths that contribute to a relative phase shift between light of a first light beam propagated along the first light path and light of a second light beam propagated along the second light path;

a first ring resonator disposed adjacent to the first waveguide such that light of the first light beam is coupled between the first waveguide and the first ring resonator so as to impart a first wavelength dependent variation in phase and intensity to the first light beam which is dependent upon the optical circumference path length of the first ring resonator; and

a second ring resonator disposed adjacent to the second waveguide such that light of the second light beam is coupled between the second waveguide and the second ring resonator so as to impart a second wavelength dependent variation in phase and intensity to the second light beam which is dependent upon the optical path length of the second ring resonator.

22. The optical interleaver of claim 21 wherein the first coupler includes a 3-dB coupler.

23. The optical interleaver of claim 21 wherein the first coupler includes a 3-dB coupler and the second coupler includes a 3-dB coupler.

24. The optical interleaver of claim 21 wherein the first interferometer includes a Mach-Zhender interferometer.

25. An optical interleaver comprising:

a Mach-Zhender interferometer which includes a first coupler and a second coupler which are interconnected by a first light path between the first coupler and the second coupler and which are interconnected by a second light path between the first coupler and the second coupler; wherein the first light path includes a first waveguide optically coupled to a first Gires Tournois resonator and wherein the second light path includes a second waveguide optically coupled to a second Gires Tournois resonator and wherein the first and second light paths have different path lengths that contribute to a relative phase shift between light of a first light beam propagated along the first light path and light of a second light beam propagated along the second light path;

wherein the first Gires Tournois resonator includes a front mirror and a back mirror spaced apart by a first distance; and

wherein the second Gires Tournois resonator includes a front mirror and a back mirror spaced apart by a second distance different from the first distance.

26. The optical interleaver of claim 25 further including:

a first collimating lens disposed between the first waveguide and the first Gires Tournois resonator; and

a second collimating lens disposed between the second waveguide and the second Gires Tournois resonator.

27. The optical interleaver of claim 25 further including:

a first collimating lens disposed between the first waveguide and the first Gires Tournois resonator; and

a second collimating lens disposed between the second waveguide and the second Gires Tournois resonator

wherein the first waveguide includes two branches optically coupled through the first collimating lens and the first Gires Tournois resonator; and

wherein the second waveguide includes two branches optically coupled through the second collimating lens and the second Gires Tournois resonator.

28. The optical interleaver of claim 25 wherein the first coupler includes a 3-dB coupler.

29. The optical interleaver of claim 25 wherein the first coupler includes a 3-dB coupler and the second coupler includes a 3-dB coupler.

30. An optical interleaver comprising:

a Mach-Zhender interferometer which includes a first fiber coupler and a second fiber coupler which are interconnected by a first light path between the first coupler and the second coupler and which are interconnected by a second light path between the first coupler and the second coupler wherein the first light path includes a first fiber path optically coupled to a first Gires Tournois resonator and wherein the second light path includes a second fiber path optically coupled to a second Gires Tournois resonator and wherein the first and second light paths have different path lengths that contribute to a relative phase shift between light of a first light beam propagated along the first light path and light of a second light beam propagated along the second light path;

wherein the first Gires Tournois resonator includes a front mirror and a back mirror spaced apart by a first distance; and

wherein the second Gires Tournois resonator includes a front mirror and a back mirror spaced apart by a second distance different from the first distance.

31. The optical interleaver of claim 30 further including:

a first collimating lens disposed between the first fiber path and the first Gires Tournois resonator; and

a second collimating lens disposed between the second fiber path and the second Gires Tournois resonator.

32. The optical interleaver of claim 30 further including:

a first collimating lens disposed between the first fiber path and the first Gires Tournois resonator; and

a second collimating lens disposed between the second fiber path and the second Gires Tournois resonator

wherein the first fiber path includes two branches optically coupled through the first collimating lens and the first Gires Tournois resonator; and

wherein the second fiber path includes two branches optically coupled through the second collimating lens and the second Gires Tournois.

33. The optical interleaver of claim 30 wherein the first fiber coupler includes a 3-dB coupler.

34. The optical interleaver of claim 30 wherein the first fiber coupler includes a 3-dB coupler and the second fiber coupler includes a 3-dB coupler.

35. An optical interleaver comprising:

a Mach-Zhender interferometer which includes a first coupler and a second coupler and a first waveguide light path between the first and second couplers and a second waveguide light path between the first and second couplers; wherein the first and second light paths have different path lengths that contribute to a phase shift between first light propagated along the first path and second light propagated along the second path;

a second phase shifter which includes at least one second Mach-Zhender interferometer optically coupled to receive first light beam light propagated along the first path between the first coupler and the second coupler and which imparts a wavelength dependent variation in phase and intensity to the received first light beam light; and

a third phase shifter which includes at least one third Mach-Zhender interferometer optically coupled to receive second light beam light propagated along the second path between the first coupler and the second coupler and which imparts a wavelength dependent variation in phase and intensity to the received second light beam light.

36. The optical interleaver of claim 35 wherein the first coupler includes a 3-dB coupler.

37. The optical interleaver of claim 35 wherein the first coupler includes a 3-dB coupler and the second coupler includes a 3-dB coupler.

38. An optical interleaver comprising:

an interferometer which includes a coupler, a first phase shifter and a combiner;

wherein the coupler splits incident light into a first light beam and a second light beam and couples the first light beam and the second light beam to the first phase shifter;

wherein the first phase shifter includes a first light propagation element that propagates the first light beam along a first path between the coupler and the combiner and that includes a second light propagation element that propagates the second light beam along a second path between the coupler and the combiner, the first and second paths having different path lengths that contribute to a phase shift between light of the first light beam propagated along the first path and light of the second light beam propagated along the second path;

wherein the combiner interferometrically couples the first light beam with and the second light beam;

a second phase shifter which receives first light beam light propagated along the first path between the coupler and the combiner and imparts a first wavelength dependent variation in phase to the received first light beam light;

a third phase shifter which receives second light beam light propagated along the second path between the coupler and the combiner and imparts a second wavelength dependent variation in phase to the received second light beam light; and

a phase shift tuner which adjusts a phase shift imparted by a difference in path lengths between the first and second light paths.